

Antibaryon to Baryon Production Ratios in Pb-Pb and p-p collision at LHC energies of the DPMJET-III Monte Carlo

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Abstract. A sizable component of stopped baryons is predicted for pp and $PbPb$ collisions at LHC. Based on an analysis of RHIC data within framework of our multichain Monte Carlo DPMJET-III the LHC predictions are presented.

- [1] G. Veneziano, Nucl. Phys. B **117** (1976) 519; G.C. Rossi and G. Veneziano, Nucl. Phys. B **123** (1977) 507; Phys. Rept. **63** (1980) 153.
- [2] J. Bartels, L. N. Lipatov and G. P. Vacca, ‘A new odderon solution in perturbative QCD,’ Phys. Lett. **B477** (2000) 178 [hep-ph/9912423].
- [3] F. Bopp and M. Shabelski, ‘String junction effects for forward and central baryon production in hadron nucleus collisions,’ Eur. Phys. J. A **28** (2006) 237 [arXiv:hep-ph/0603193].
- [4] S. Roesler, R. Engel and J. Ranft: hep-ph/0012252, Proc. of Monte Carlo 2000, Lisboa, Oct.2000, Springer,p.1033
- [5] F. W. Bopp, J. Ranft, R. Engel and S. Roesler, ‘Antiparticle to particle production ratios in d Au and p p collisions in the DPMJET-III Monte Carlo,’ arXiv:hep-ph/0505035v1 (to be submitted soon arXiv:hep-ph/0505035v2).

This addendum to Ranft's talk about the main DPMJET III prediction addresses baryon stopping. The interest is a component without leading quarks. Where the flavor decomposition is not determined by final state interactions the valence-quarkless component can be enhanced by considering net strange baryons.

In models, in which soft gluons can arbitrarily arrange colors, a configuration can appear in which the baryonic charge ends up moved to the center. The actual transport is just an effect of the orientation of the color-compensation during the soft hadronisation. Various other ideas about fast baryon stopping exist but to have it caused by such an "initial" process is an attractive option.

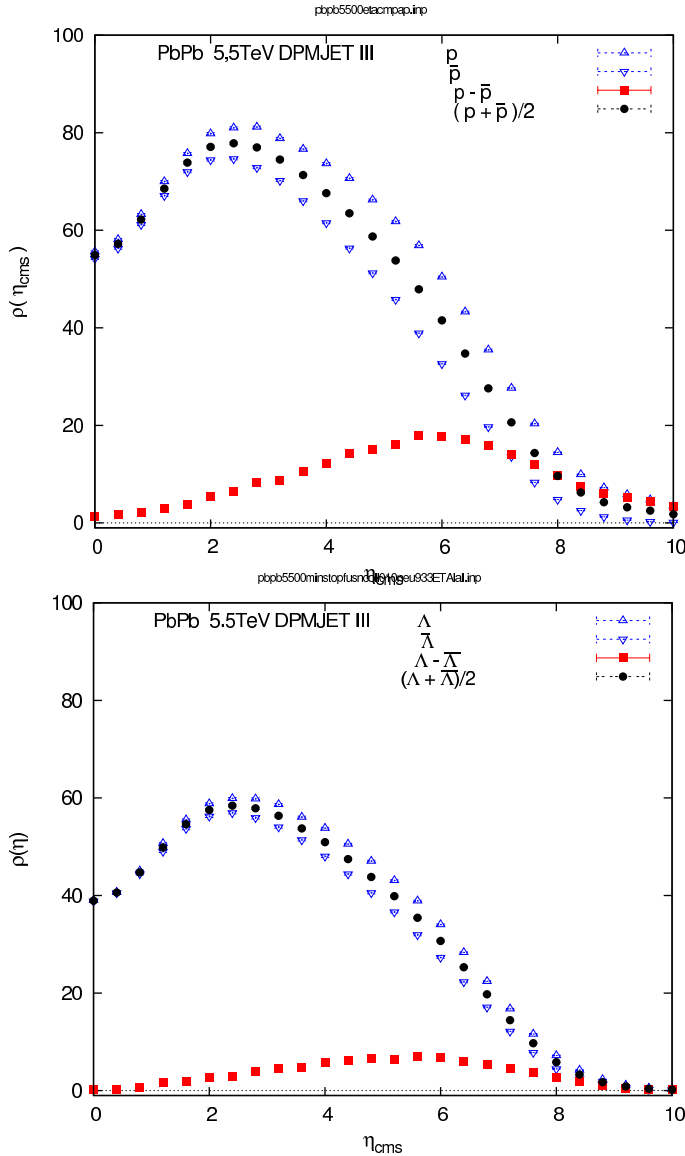
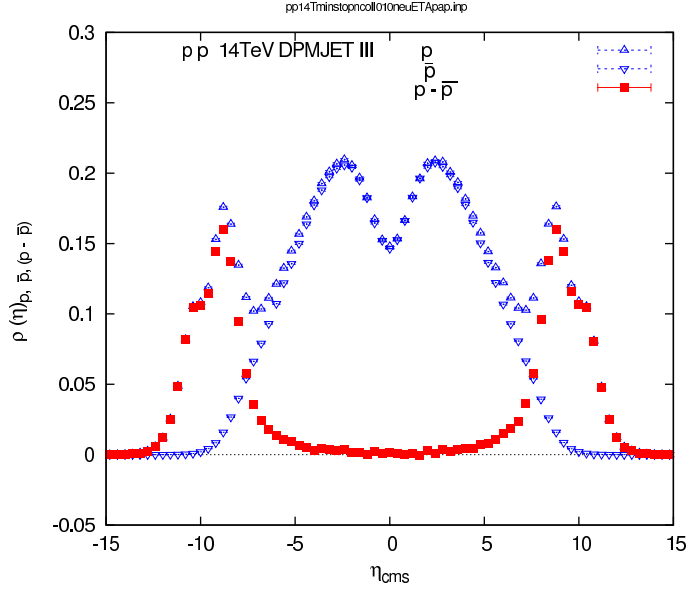
The "Dual-Topological" phenomenology of such baryon transport processes was developed 30 years ago[1]. Critical are various baryonium-exchange intercepts which were estimated at that time. Some ambiguity remains until today for the quarkless component (also called "string junction" exchange denoted as $\{SJ\}$) and a confirmation of the flat net-baryon distribution indicated by RHIC data at LHC would be helpful.

Nowadays it is postulated that at very high energy hadronic scattering can be understood as extrapolation of BFKL Pomeron exchanges[2] and their condensates in the minimum bias region. BFKL Pomerons are described by ladders of dispersion graphs, in which soft effects are included using effective gluons. In principle these soft effects include the color compensating mechanism usually modelled as two strings neutralizing triplet colors. A necessary ingredient in this approach are *Odderons* exchanges with Pomeron-like intercepts and with presumably much smaller couplings. As these Odderons can produce a baryon exchange of the type discussed above, a small rather flat net baryon component is expected.

Experimentally, the first indication for a flat component came from never finalized preliminary ZEUS data at HERA. As RHIC runs pp or *heavy ions* instead of $p\bar{p}$ this question could be addressed much better than before and the data seem to require a flat contribution. In a factorizing Quark-Gluon-String model calculation[3] the best fit to RHIC BRAHMS pp data at $\sqrt{s} = 200$ GeV required diquarks with a probability of $\epsilon = 0.024$ to involve a quarkless baryonium-exchange with an intercept $\alpha_{\{SJ\}} = 0.9$.

To obtain such a quarkless baryonium-exchange in the microscopic generator DPMJET III[4] a new string interaction reshuffling the initial strings was introduced. It introduces an exchange with a conservative intercept of $\alpha_{\{SJ\}} = 0.5$. With this baryonium addition good fits were obtained for various baryon ratios in $p - p$ and $d - Au$ RHIC and $\pi - p$ FERMILAB processes[5]. There are of course a number of more conventional baryon transport mechanisms implemented in the model. As the string interaction requires multiple Pomeron exchanges the new mechanism is actually only a 10% effect at pp RHIC. It is, however, important for heavy ion scattering or at LHC energies.

For pp LHC the DPMJET III prediction for the pseudo rapidity of p , \bar{p} , and $p - \bar{p}$ is shown in the Figure on the right. The new baryon stopping is now a 40% effect. Of course, with the effective intercept of 0.5 the present implementation of the baryon stopping is a rather conservative estimate. For an intercept of 1.0 the value at $\eta = 0$ would roughly correspond to the present value of $\eta = 4$



We now turn to DPMJET III prediction for central $PbPb$ LHC. For the most central 10% of the heavy ion events the pseudorapidity proton and Λ distributions are given in figures below. The $PbPb$ results are preliminary, as the model is not well tested in this region.